Module Overview

This module, an extension of the Core Curriculum safety module, identifies general safety considerations that apply to welding and metal cutting. It describes the steps that must be taken to avoid job-related deaths and injuries while establishing and maintaining a safe work environment.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed Core Curriculum: Introductory Craft Skills.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify some common hazards in welding.
2. Explain and identify proper personal protection used in welding.
3. Describe how to avoid welding fumes.
4. Explain some of the causes of accidents.
5. Identify and explain uses for material safety data sheets.
6. Explain safety techniques for storing and handling cylinders.
7. Explain how to avoid electric shock when welding.
8. Describe proper material handling methods.

Performance Tasks

This is a knowledge-based module. There are no Performance Tasks.

Materials and Equipment List

| Markers/chalk                              | Various welding gloves                  |
| Pencils and scratch paper                 | Samples of protective welding footwear  |
| Whiteboard/chalkboard                    | Earplugs                                |
| Structural Fitter Level One PowerPoint®  | Various welding and cutting helmets with face shields |
| Presentation Slides can be downloaded (with your access code) from www.nccerirc.com | Welding helmet with auto-darkening lens |
| Multimedia projector and screen          | Full-face supplied-air respirator (SAR) |
| Desktop or laptop computer               | Oxyfuel gas cutting/welding equipment  |
| Appropriate personal protective equipment | Module Examinations*                    |
| Leather protective gear                  |                                         |

* Single-module AIG purchases include the printed exam. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize the special safety precautions associated with welding because of the added potential for fire, burns, respiratory problems, and electrical shock. Ensure that trainees are briefed on shop safety procedures.
Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.


Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 2½ hours are suggested to cover Welding Safety. You will need to adjust the time required for testing based on your class size and resources. There are no performance tasks for this module.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td>Session I. Introduction; Welding Safety Practices; Review and Testing</td>
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<tr>
<td>A. Introduction</td>
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<tr>
<td>B. Welding Safety Practices</td>
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<td>C. Appropriate Personal Protective Equipment</td>
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<td>D. Fumes and Gases</td>
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<td>E. Confined Space Permits</td>
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<td>G. Hot Work Permits and Fire Watches</td>
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<td>H. Oxyfuel Gas Welding and Cutting Safety</td>
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<td>I. Cutting Containers</td>
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<td>J. Cylinder Storage and Handling</td>
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<td>K. Power Tool Safety</td>
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<td>L. Electrical Safety</td>
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<td>M. Material Safety Data Sheets</td>
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<td>N. Material Handling</td>
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<td>O. Safety Planning and Emergency Action Plans</td>
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<td>P. Module Review</td>
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<tr>
<td>Q. Module Examination</td>
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<tr>
<td>1. Trainees must score 70% or higher to receive recognition from NCCER.</td>
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<tr>
<td>2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.</td>
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</table>
Module Overview
This module teaches principles of safe oxyfuel cutting. Setup, care, and maintenance are covered, as well as procedures and methods for performing various types of oxyfuel cuts.

Prerequisites
Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum.

Objectives
Upon completion of this module, the trainee will be able to do the following:
1. Identify and explain the use of oxyfuel cutting equipment.
2. Set up oxyfuel equipment.
3. Light and adjust an oxyfuel torch.
4. Shut down oxyfuel cutting equipment.
5. Disassemble oxyfuel equipment.
7. Perform oxyfuel cutting:
   • Straight line and square shapes
   • Piercing and slot cutting
   • Bevels
   • Washing
   • Gouging
8. Operate a motorized, portable oxyfuel gas cutting machine.

Performance Tasks
1. Set up oxyfuel equipment.
2. Light and adjust an oxyfuel torch.
3. Shut down oxyfuel cutting equipment.
4. Disassemble oxyfuel equipment.
5. Change empty cylinders.
6. Cut shapes from various thicknesses of steel, emphasizing:
   • Straight line
   • Square shape
   • Piercing
   • Bevel
   • Slot
7. Perform washing.
8. Perform gouging.

Materials and Equipment List

| Markers/chalk | Oxygen cylinder (with cap) |
| Pencils and scratch paper | Fuel gas cylinder (with cap) |
| Whiteboard/chalkboard | Extra empty cylinders |
| Structural Fitter Level One PowerPoint® | Regulators (oxygen and fuel gas) |
| Presentation Slides can be downloaded (with your access code) from www.nccerirc.com | Extra regulators with check valves and flashback arrestors |
| Multimedia projector and screen | Hose set |
| Desktop or laptop computer | A selection of usable and non-usable hoses |
| Appropriate personal protective equipment | Combination cutting torch |

(continued)
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize the special safety precautions associated with the handling and use of cylinders and oxyfuel cutting equipment. Ensure that trainees are briefed on shop safety procedures.

Additional Resources

This module is intended to present thorough resources for task training. The following reference work is suggested for both instructors and motivated trainees interested in further study. This is optional material for continued education rather than for task training.

ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes, American Welding Society, Miami, FL.

Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 17½ hours are suggested to cover Oxyfuel Cutting. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<td>Session I. Introduction to Oxyfuel Safety; Oxyfuel Cutting Equipment, Part One</td>
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<tr>
<td>A. Introduction</td>
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<tr>
<td>B. Oxyfuel Safety Summary</td>
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<tr>
<td>1. Protective Clothing and Equipment</td>
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<td>2. Fire/Explosion Prevention</td>
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<td>3. Work Area Ventilation</td>
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<td>C. Oxyfuel Cutting Equipment</td>
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<tr>
<td>1. Oxygen</td>
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<td>2. Acetylene</td>
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<td>3. Liquefied Fuel Gases</td>
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<td>4. Regulators</td>
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<td>4a. Laboratory</td>
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<tr>
<td>Allow trainees to install and remove regulators from empty oxygen and gas cylinders.</td>
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<td>5. Hoses</td>
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</tbody>
</table>

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
Session II. Oxyfuel Cutting Equipment, Part Two
A. Cutting Torches
B. Cutting Torch Tips
C. Tip Cleaners and Tip Drills
D. Friction Lighters
E. Cylinder Cart
F. Soapstone Markers
G. Specialized Cutting Equipment

Session III. Setting Up Oxyfuel Equipment; Controlling the Oxyfuel Torch Flame
A. Setting Up Oxyfuel Equipment
   1. Transporting and Securing Cylinders
   2. Cracking Cylinder Valves
   3. Attaching Regulators
   4. Installing Flashback Arrestors or Check Valves
   5. Connecting Hoses to Regulators
   6. Attaching Hoses to the Torch
   7. Connecting Cutting Attachments (Combination Torch Only)
   8. Installing Cutting Tips
   9. Closing Torch Valves and Loosening Regulator Adjusting Screws
   10. Opening Cylinder Valves
   11. Purging the Torch and Setting the Working Pressures
   12. Testing for Leaks
B. Controlling the Oxyfuel Torch Flame
   1. Oxyfuel Flames
   2. Backfires and Flashbacks
   3. Igniting the Torch and Adjusting the Flame
   4. Shutting Off the Torch

Session IV. Shutting Down Oxyfuel Cutting Equipment; Disassembling Oxyfuel Equipment; Changing Cylinders
A. Shutting Down Oxyfuel Cutting Equipment
B. Disassembling Oxyfuel Equipment
C. Changing Cylinders
D. Laboratory
   Have trainees set up, ignite, adjust, shut down, and disassemble oxyfuel equipment, as well as change cylinders. This laboratory corresponds to Performance Tasks 1 through 5.

Session V. Performing Cutting Procedures, Part One
A. Performing Cutting Procedures
   1. Inspecting the Cut
   2. Preparing for Oxyfuel Cutting with a Hand Cutting Torch
   3. Cutting Thin Steel
   4. Cutting Thick Steel
   5. Piercing a Plate
   6. Cutting Bevels
   7. Washing
   8. Gouging
Session VI. Performing Cutting Procedures, Part Two; Portable Oxyfuel Cutting Machine Operation

A. Laboratory
   Have trainees perform straight-line cutting, square shape cutting, piercing, slot cutting, bevel cutting, washing, and gouging. This laboratory corresponds to Performance Tasks 6 through 8.

B. Portable Oxyfuel Cutting Machine Operation
   1. Torch Adjustment
   2. Straight-Line Cutting
      a. Laboratory
      Allow trainees to practice straight-line cutting with an oxyfuel machine.
   3. Bevel Cutting
      a. Laboratory
      Allow trainees to practice bevel cutting with an oxyfuel machine.

Session VII. Review and Testing

A. Module Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing
   1. Trainees must complete each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.
   2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

D. Performance Accreditation Tasks – Have trainees complete PATs 1 through 3 according to the acceptance criteria.
   1. Have trainees perform PAT 1, Setting Up, Igniting, Adjusting, and Shutting Down Oxyfuel Equipment. This task corresponds to AWS EG2.0, Module 8 – Thermal Cutting Processes, Unit 1 – Manual OFC Principles, Key Indicators: 3 and 4.
   2. Have trainees perform PAT 2, Cutting a Shape from Thin Steel. This task corresponds to AWS EG2.0, Module 8 – Thermal Cutting Processes, Unit 1 – Manual OFC Principles, Key Indicators: 5, 6, and 7.
   3. Have trainees perform PAT 3, Cutting a Shape from Thick Steel. This task corresponds to AWS EG2.0, Module 8 – Thermal Cutting Processes, Unit 1 – Manual OFC Principles, Key Indicators: 5, 6, and 7.
Module Overview
This module teaches how to clean base metals for welding and cutting, how to identify and explain joint design, and how to prepare base metal joints for welding.

Prerequisites
Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum.

Objectives
Upon completion of this module, the trainee will be able to do the following:
1. Clean base metal for welding or cutting.
2. Identify and explain joint design.
3. Explain joint design considerations.
4. Mechanically bevel the edge of a mild steel plate.
5. Thermally bevel the end of a mild steel plate.
6. Select the proper joint design based on a welding procedure specification (WPS) or instructor direction.

Performance Tasks
Under the supervision of the instructor, the trainee should be able to:
1. Mechanically bevel the edge of a mild steel plate ¼” to ¾” thick at 22½ degrees (or 30 degrees, depending on the equipment available).
2. Thermally prepare a bevel.

Materials and Equipment List

| Markers/chalk | Examples of plug and slot welds |
| Pencils and scratch paper | Examples of fillet welds |
| Whiteboard/chalkboard | Sections of bar stock to illustrate various joints |
| *Structural Fitter Level One PowerPoint®* Presentation Slides can be downloaded (with your access code) from www.nccerirc.com | An oxyfuel or plasma arcing system or pictures showing how these systems can be used for joint preparation |
| Multimedia projector and screen | Properly beveled coupons |
| Desktop or laptop computer | Chipping hammer |
| Appropriate personal protective equipment | Soapstone |
| Full face shields | Tape measure |
| Examples (photos or actual objects) of metals that have and have not been prepared for welding | Pliers |
| Examples of surface corrosion on different metals | Files |
| Examples of defects caused by surface contamination | Framing square |
| MSDSs for metal cleaning chemicals | Combination square with protractor head |
| Examples of welding drawings and welding procedure specifications | Hand scrapers and wire brushes |
| Examples of surfacing welds | Power grinder with grinding and wire brush attachments |
| Photos of surfacing welds before and after being ground down and cleaned | Mechanical beveling equipment for plate |
| * Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
**Safety Considerations**

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize any special safety precautions associated with cutting and shaping metal because of the added potential for fire, burns, respiratory problems, and electrical shock. Ensure that trainees are briefed on shop safety procedures.

**Additional Resources**

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

*OSHA Standard 1926.351, Arc Welding and Cutting*
*www.lincolnelectric.com*

**Teaching Time for this Module**

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 12½ hours are suggested to cover Base Metal Preparation. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<tr>
<th>Topic</th>
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<td><strong>Session I. Introduction; Basic Welding Safety; Base Metal Cleaning</strong></td>
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<td>A. Introduction</td>
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<tr>
<td>B. Basic Welding Safety</td>
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<tr>
<td>1. Protective Clothing and Equipment for Preparing Metals</td>
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<td>2. Fire/Explosion Prevention</td>
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<td>3. Work Area Ventilation</td>
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<td>C. Base Metal Cleaning</td>
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<td>1. Surface Corrosion</td>
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<td>2. Defects Caused by Surface Contamination</td>
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<td>3. Mechanical Cleaning</td>
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<td>4. Chemical Cleaning</td>
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<td><strong>Session II. Joint Design I</strong></td>
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<td>A. Load Considerations</td>
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<td>B. Types of Joints</td>
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<td>C. Types of Welds</td>
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<td><strong>Session III. Joint Design II</strong></td>
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<td>A. Types of Welds (continued)</td>
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<td>B. Welding Position</td>
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<td>C. Codes and Welding Procedure Specifications</td>
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<td>D. Welding Joint Preparation</td>
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<tr>
<td>1. Identify Joint Specification</td>
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<td>2. Mechanical Joint Preparation</td>
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</table>
Session IV. Laboratory; Welding Joint Preparation (Continued)

A. Laboratory
Have trainees practice beveling steel plate by mechanical means. This laboratory corresponds to Performance Task 1.

B. Thermal Joint Preparation

Session V. Laboratory; Review and Testing

A. Laboratory
Have trainees practice beveling steel plate by thermal means. This laboratory corresponds to Performance Task 2.

B. Module Review

C. Module Examination
1. Trainees must score 70% or higher to receive recognition from the NCCER.
2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

D. Performance Testing
1. Trainees must complete each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.
2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

E. Performance Accreditation Tasks - Have trainees complete PATs 1 and 2 according to the acceptance criteria.
1. Have trainees perform PAT 1, Prepare Plate Joints Mechanically. This task has no AWS EG2.0 reference.
2. Have trainees perform PAT 2, Prepare Plate Joints Thermally. This task corresponds to AWS EG2.0, Module 8 – Thermal Cutting Processes, Unit 2 – Manual OFC Principles, Key Indicators: 4, 5, and 6.
Module Overview

This module teaches the importance of quality workmanship and covers how to find, identify, and avoid weld imperfections while adhering to necessary codes and specifications.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain codes governing welding.
2. Identify and explain weld imperfections and their causes.
3. Identify and explain nondestructive examination practices.
4. Identify and explain welder qualification tests.
5. Explain the importance of quality workmanship.
6. Identify common destructive testing methods.
7. Perform a visual inspection of fillet welds.

Performance Tasks

There are no performance tasks for this module.

Materials and Equipment List

Markers/chalk
Pencils and scratch paper
Whiteboard/chalkboard
Structural Fitter Level One PowerPoint® Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
Multimedia projector and screen
Desktop or laptop computer
Appropriate personal protective equipment
Welding samples showing:
  • Porosity
  • Inclusions
  • Cracks
  • Weld metal cracks
  • Base metal cracks
  • Incomplete joint penetration
  • Incomplete fusion
  • Undercut
  • Arc strikes
  • Spatter
  • Unacceptable weld profiles

Undercut gauge
Butt weld reinforcement gauge
Fillet weld blade gauge set
Welding coupon examples
Weld metal cracks
Base metal cracks
Incomplete joint penetration
Incomplete fusion
Undercut
Arc strikes
Spatter
Unacceptable weld profiles

Photos of damage to equipment and structures caused by failed welds
Examples of Welding Procedure Specifications and Procedure Qualification Records
Liquid penetrant test kit
Radiograph examples
Tested specimens of good and failed welds
Module Examinations*

* Single-module AIG purchases include the printed exam. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment. Review general safety guidelines associated with welding and refer to the MSDS for liquid penetrant solvent.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

*OSHA Standard 1926.351, Arc Welding and Cutting.*

Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover Weld Quality. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

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<tr>
<td>A. Introduction</td>
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<td>B. Codes Governing Welding</td>
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<tr>
<td>1. American Society of Mechanical Engineers</td>
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<td>2. American Welding Society</td>
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<td>3. American Petroleum Institute</td>
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<td>4. American National Standards Institute</td>
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<td>5. Marine Codes</td>
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<td>C. Basic Elements of Welding Codes</td>
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<td>1. Welding Procedure Qualification</td>
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<td>2. Welder Performance Qualification</td>
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<td>3. Welder Operator Qualification</td>
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<td>D. Weld Discontinuities and Their Causes</td>
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<td>1. Porosity</td>
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<td>2. Inclusions</td>
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<td>3. Cracks</td>
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<td>4. Incomplete Joint Penetration</td>
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<td>5. Incomplete Fusion</td>
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<td>6. Undercut</td>
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<td>7. Arc Strikes</td>
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<td>8. Spatter</td>
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<td>9. Acceptable and Unacceptable Weld Profiles</td>
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</table>
Session II. Nondestructive Examination (NDE) Practices
   A. Visual Inspection
   B. Liquid Penetrant Inspection
   C. Magnetic Particle Inspection
   D. Radiographic Inspection
   E. Ultrasonic Inspection
   F. Electromagnetic (Eddy Current) Inspection
   G. Leak Testing

Session III. Destructive Testing; Welder Performance Qualification Tests
   A. Destructive Testing
   B. Welder Performance Qualification Tests
      1. Welding Positions Qualification
      2. AWS Structural Steel Code
      3. ASME Code
      4. Welder Qualification Tests

Session IV. Quality Workmanship; Review and Testing
   A. Quality Workmanship
      1. Typical Site Organization
      2. Chain of Command
   B. Module Review
   C. Module Examination
      1. Trainees must score 70% or higher to receive recognition from the NCCER.
      2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.
Module Overview

This module discusses the classification, selection, storage, and control of electrodes that are used for shielded metal arc welding.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify factors that affect electrode selection.
2. Explain the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME) filler metal classification system.
3. Identify different types of filler metals.
4. Explain the storage and control of filler metals.
5. Explain filler metal traceability requirements and how to use applicable code requirements.
6. Identify and select the proper electrode for an identified welding task.

Performance Tasks

There are no performance tasks for this module.

Materials and Equipment List

- Markers/chalk
- Pencils and scratch paper
- Whiteboard/chalkboard
- Structural Fitter Level One PowerPoint®
  - Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
- Multimedia projector and screen
- Desktop or laptop computer
- Appropriate personal protective equipment
- Electrodes of various types
- Sample MSDS for an electrode
- Sample MSDS for a surface coating
- Module Examinations*

* Single-module AIG purchases include the printed exam. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment. Review general safety guidelines associated with welding and refer to the MSDS for each electrode type. Point out that many surface coatings produce toxic fumes when heated.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

- OSHA Standard 1926.351, Arc Welding and Cutting.
Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2 1/2 hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 2 1/2 hours are suggested to cover Shielded Metal Arc Welding – Electrodes. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

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<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
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<td><strong>Session I. Introduction; SMAW Electrodes; Review and Examination</strong></td>
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<tr>
<td>A. Introduction</td>
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<td>B. Shielded Metal Arc Welding Electrodes</td>
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<td>C. AWS Filler Metal Specification System</td>
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<td>D. Selecting Electrodes</td>
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<td>2. Electrode Selection Considerations</td>
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<td>E. Filler Metal Storage and Control</td>
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<td>1. Code Requirements</td>
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<td>2. Receiving Filler Metal</td>
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<td>3. Storing Filler Metal</td>
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<td>4. Storage Ovens</td>
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<td>F. Filler Metal Traceability Requirements</td>
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<td>G. Module Review</td>
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<td>H. Module Examination</td>
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<tr>
<td>1. Trainees must score 70% or higher to receive recognition from the NCCER.</td>
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<tr>
<td>2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.</td>
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</table>
Module Overview

This module explains the proper setup of arc welding equipment. It describes the methods of striking an arc and how to properly perform a tack weld. Trainees will perform tack weld techniques that include flat, horizontal, vertical, and overhead.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the Maritime Core Curriculum and Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Set up proper arc welding equipment.
2. Describe methods of striking an arc.
3. Describe how to properly perform a tack weld.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Set up proper arc welding equipment.
2. Properly strike and extinguish an arc.
3. Perform tack welds in the following positions to be break-tested by the instructor:
   - Flat (1F)
   - Horizontal (2F)
   - Vertical (3F)
   - Overhead (4F)

Materials and Equipment List

Multimedia projector and screen

Structural Fitter Level One PowerPoint® Presentation Slides can be downloaded (with your access code) from www.nccerirc.com

Desktop or laptop computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Welding safety video (optional)

Appropriate personal protective equipment

- Safety goggles
- Face shields
- Welding helmets
- Ear protection
- Welding caps
- Minimum 8"-high safety boots
- Leather/flame retardant clothing
- Welding gloves
- Respirators
- Safety harness

SMAW welding machine

Leads

Welding cables

Ground connectors

Hoses

Lugs

Quick disconnects

Workpiece clamps

Electrode holder

E6010 electrodes 3⁄32" or 1⁄8"

E6011 electrodes 3⁄32" or 1⁄8"

E7018 electrodes 3⁄2" or 1⁄8"

Welding station

Fire extinguisher

Welding coupons

Oxygen cylinder with cap

Fuel gas cylinder with cap

Regulators (oxygen and fuel gas)

Cylinder cart

Tape measure

(continued)
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires that the trainees perform tack welding. Ensure that trainees are briefed on fire and shop safety policies prior to performing any work. Emphasize the special safety precautions associated with welding.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

  * www.lincolnelectric.com

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 40 hours are suggested to cover Tack Welding. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
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<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
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<td><strong>Session I. Introduction; Safety Summary; Welding Current</strong></td>
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<td>A. Introduction</td>
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<td>B. Safety Summary</td>
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<td>2. Fire/Explosion Prevention</td>
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<td>3. Work Area Ventilation</td>
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<td>4. Lifting Hazards</td>
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<td>5. Working at Heights</td>
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<td>C. Welding Current</td>
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<td>1. Types of Welding Current</td>
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<td>2. Polarity</td>
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<td>3. Characteristics of Welding Current</td>
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<td><strong>Session II. SMAW Machines; Tools for Cleaning Welds</strong></td>
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<td>A. SMAW Machines</td>
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<td>1. SMAW Machine Classifications</td>
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<td>2. Industrial SMAW Machine Types</td>
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<td>3. SMAW Machine Ratings</td>
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<td>4. SMAW Cable Terminations</td>
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</tbody>
</table>
B. Tools for Cleaning Welds
   1. Hand Tools
   2. Pneumatic Cleaning and Slag Removal Tools

Sessions III–V. Arc Welding Equipment Setup
   A. Arc Welding Equipment Setup
      1. Preparing the Welding Area
      2. Preparing Tack Weld Coupons
      3. Electrodes
      4. Preparing the Welding Machine
   B. PT/Laboratory
      Have trainees set up the arc welding equipment. This laboratory corresponds to Performance Task 1.

Sessions VI–VIII. Striking an Arc
   A. Striking an Arc
      1. Scratching Method
      2. Tapping Method
      3. Practicing Striking and Extinguishing an Arc
   B. PT/Laboratory
      Have trainees properly strike and extinguish arcs. This laboratory corresponds to Performance Task 2.

Session IX. Arc Blow; Tack Weld Beads; Fillet Tack Welds
   A. Arc Blow
   B. Tack Weld Beads
      1. Practicing Tack Weld Beads with E6010
      2. Practicing Tack Weld Beads with E7018
   C. Fillet Tack Welds
      1. Fillet Weld Positions
      2. Practicing Horizontal Fillet Tack Welds with E6010 (2F Position)
      3. Practicing Horizontal Fillet Tack Welds with E7018 (2F Position)
      4. Practicing Vertical Fillet Tack Welds with E6010 (3F Position)
      5. Practicing Vertical Fillet Tack Welds with E7018 (3F Position)
      6. Practicing Overhead Fillet Tack Welds with E6010 (4F Position)
      7. Practicing Overhead Fillet Tack Welds with E7018 (4F Position)

Sessions X–XV. Practice Weldments
   A. Practice Weldments
   B. PT/Laboratory
      1. Have trainees practice making tack weld beads. This laboratory corresponds to Performance Task 3.
      2. Have trainees practice making tack welds in the flat (1F), horizontal (2F), vertical (3F), and overhead (4F) positions with E6010 and E7018 electrodes. These laboratories correspond to Performance Task 3.
Session XVI. Review and Testing

A. Review

B. Module Examination
   1. Trainees must score 70 percent or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
Module Overview

This module explains the classifications of fires and the methods used to extinguish them, the duties and responsibilities of the fire watch, and the inspection requirements for the various types of fire extinguishers.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the Maritime Core Curriculum, Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09, and 86101-14.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the different classes of fires and the methods used to extinguish them.
2. Explain the duties and responsibilities of a fire watch.
3. Describe the different types of fire extinguishers and their inspection requirements.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Demonstrate the RACE method in response to a simulated fire.
2. Demonstrate the PASS method on a simulated fire.
3. Complete a fire watch test.
4. Select the correct fire extinguisher for different classes of fires.
5. Inspect extinguishers and their components.

Materials and Equipment List

- Multimedia projector and screen
- Structural Fitter Level One PowerPoint® Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
- Desktop or laptop computer
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and scratch paper
- Welding safety video (optional)
- 29 CFR Part 1915 Subpart B

- Fire extinguishers for Class A, B, and C fires
- Appropriate personal protective equipment: Hard hat, Safety glasses, Goggles, Steel-toed boots, Long-sleeved 100-percent cotton shirt, Hearing protection
- Module Examinations*
- Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires that the trainees perform simulated fire extinguishing methods.
Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2 1⁄2 hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 5 hours are suggested to cover Fire Watch. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td><strong>Session I. Introduction; About Fires; Fire Watch Duties and Responsibilities; Fire Extinguishers</strong></td>
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<tr>
<td>A. Introduction</td>
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<tr>
<td>B. About Fires</td>
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<tr>
<td>1. Classes of Fires</td>
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<td>C. Fire Watch Duties and Responsibilities</td>
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<tr>
<td>1. Basic Responsibilities</td>
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<td>2. Preparing for Fire Watch Duty</td>
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<td>D. Fire Extinguishers</td>
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<tr>
<td>1. Using a Fire Extinguisher</td>
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<tr>
<td><strong>Session II. PT/Laboratory; Review and Testing</strong></td>
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<tr>
<td>A. PT/Laboratory</td>
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<tr>
<td>1. Have trainees practice the selection and inspection of fire extinguishers. These laboratories correspond to Performance Tasks 4 and 5.</td>
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<tr>
<td>2. Have trainees practice responding to and extinguishing a fire. These laboratories correspond to Performance Tasks 1 and 2.</td>
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<tr>
<td>3. Have trainees successfully complete a fire watch test. This laboratory corresponds to Performance Task 3.</td>
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<tr>
<td>B. Review</td>
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<tr>
<td>C. Module Examination</td>
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<tr>
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<td>D. Performance Testing</td>
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</table>
Module Overview

This module explains how to recognize and identify the components of structural fitter drawings.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the Maritime Core Curriculum, Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09, and Modules 86101-14 and 86102-14.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Recognize and identify basic fabrication drawing terms, components, basic lines, symbols, and bills of material.
2. Identify various drawing views such as plan, elevation, section, and details.

Performance Task

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify components on a bill of materials and their location on a fabrication drawing.

Materials and Equipment List

Multimedia projector and screen
Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
Desktop or laptop computer
Whiteboard/chalkboard

Markers/chalk
Pencils and scratch paper
Fabrication drawings
Bills of Material
Module Examinations*
Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2 1/2 hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Introduction to Structural Fitter Drawings*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
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<td>A. Introduction</td>
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<td>B. Common Drawing Elements</td>
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<td>3. Lines</td>
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<td>4. Symbol and Abbreviation Legends</td>
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<td>C. Reference Lines</td>
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<td>A. Drawing Views</td>
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<td>2. Elevation Views</td>
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<td>3. Section Views</td>
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<td>4. Detail Views</td>
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<td>5. Exploded Views</td>
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<td>6. Isometric Views</td>
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<tr>
<td>B. Using Drawings</td>
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<td>C. PT/Laboratory</td>
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<tr>
<td>Have trainees identify the components on a Bill of Material and then locate them on the fabrication drawing. This laboratory corresponds to Performance Task 1.</td>
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</table>

Session IV. Review and Testing

| A. Review                                       |              |
| B. Module Examination                           |              |
| 1. Trainees must score 70 percent or higher to receive recognition from NCCER. | |
| 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor. | |
| C. Performance Testing                          |              |
| 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements. | |
| 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor. | |
Module Overview

This module explains the role of a fitter in the areas of quality assurance and safety. It also explains how to recognize and identify structural members and calculate their thickness. Additionally, the identification of fitting aids, layout tools and fitting tools will be explained. Trainees will perform proper fit procedures by interpreting drawings and instructions, removing welded fitting aids, applying math and measurements, and using alignment tools.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the Maritime Core Curriculum, Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09, and Modules 86101-14 through 86103-14.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Explain the role the fitter plays in quality assurance and safety.
2. Recognize and identify structural members and calculate their thicknesses.
3. Identify layout tools, fitting tools, and fitting aids used to fit up, align, and check plate joints.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Remove welded fittings aids properly.
2. Interpret drawings and verbal instructions for fitting/assembling.
3. Apply math calculations and use standard/metric forms of measurements to lay out and fit parts.
4. Square and mark work surfaces using the 3-4-5 method.
5. Perform proper fit procedures related to fitting tasks in the downhand (flat) position, including:
   - Longitudinals
   - Bulkheads
   - Frames
   - Miscellaneous structural items (chocks, headers, collars, brackets, clips)
6. Fit up plate joints using alignment tools and check for misalignment and poor fit-up.

Materials and Equipment List

Multimedia projector and screen
Structural Fitter Level One PowerPoint®
   Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
Desktop or laptop computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate tools and materials for:
   - Squaring and marking
   - Lay-out
   - Fitting
   - Measuring
Appropriate drawings

Appropriate personal protective equipment
   Leather, steel-toed work boots
   with at least a 6” top
   OSHA-approved safety glasses
   Hearing protection
   Hard hat
   Face shield
   Leather gloves
   Long-sleeve cotton shirt and long pants
   Safety harness
   Supplied air respirator
   Module Examinations*
   Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from your IRC using your access code.
**Safety Considerations**

This module requires that the trainees perform structural fitting. Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly.

**Additional Resources**

This module presents thorough resources for task training. The following resource material is suggested for further study.


**Teaching Time for This Module**

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 40 hours are suggested to cover *Fitting I*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<tr>
<td>A. Introduction</td>
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<td>B. Safety</td>
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<tr>
<td>1. Personal Protective Equipment (PPE)</td>
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<td>2. Safety Practices</td>
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<tr>
<td><strong>Session II. Structural Members; Fitting Tools; Fitting Aids; The Importance of Quality</strong></td>
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<tr>
<td>A. Structural Members</td>
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<td>B. Fitting Tools</td>
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<td>1. Common Hand Tools</td>
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<td>2. Hoisting and Pulling Tools</td>
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<td>3. Levels and Squares</td>
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<td>4. Grinders</td>
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<td>5. Jacks</td>
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<tr>
<td>C. Fitting Aids</td>
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<td>1. Using Fitting Aids</td>
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<td>2. Removing Fitting Aids</td>
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<td>D. The Importance of Quality</td>
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<tr>
<td>1. Determining the Thickness of Plates and Angles</td>
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<td>2. Surface Preparation</td>
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<td>3. The 3-4-5 Method for Checking Squareness</td>
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</tbody>
</table>
Sessions III–V. PT/Laboratory
A. PT/Laboratory
1. Have the trainees lay out and fit parts using the appropriate math applications and standard/metric measurements. This laboratory corresponds to Performance Task 3.
2. Have the trainees square and mark work surfaces using the 3-4-5 method. This laboratory corresponds to Performance Task 4.

Sessions VI–XV. PT/Laboratory
A. PT/Laboratory
1. Have the trainees properly remove welded fitting aids. This laboratory corresponds to Performance Task 1.
2. Have the trainees properly interpret drawings and actively listen to verbal instruction. This laboratory corresponds to Performance Task 2.
3. Have the trainees perform the proper fitting procedures in the downhand (flat) position on longitudinals, bulkheads, frames, chocks, headers, collars, brackets, and clips. This laboratory corresponds to Performance Task 5.
4. Have the trainees properly fit up plate joints using alignment tools and then check for misalignment and poor fit-up. This laboratory corresponds to Performance Task 6.

Session XVI. Review and Testing
A. Review
B. Module Examination
1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.